

CLAIMS

What is claimed is:

- 1 1. A scanning probe microscope tip coated with a layer of chemically-synthesized
2 nanoparticles.
- 1 2. The tip of claim 1, wherein said scanning probe microscope tip is one of an atomic force
2 microscope tip, a near-field scanning optical microscope tip, and a scanning tunneling microscope
3 tip.
- 1 3. The tip of claim 1, wherein said nanoparticles comprise at least one of an amorphous,
2 crystalline, ferromagnetic, paramagnetic, superparamagnetic, antiferromagnetic, ferrimagnetic,
3 magneto optic, ferroelectric, piezoelectric, superconducting, semiconducting, magnetically-doped
4 semiconducting, insulating, fluorescent, and chemically catalytic nanoparticles.
- 1 4. The tip of claim 1, wherein said nanoparticles are coated with an organic layer; wherein
2 said nanoparticles having a diameter ranging from 2 nm to 20 nm, and said organic layer having a
3 thickness ranging from 0.5 nm to 5 nm.
- 1 5. The tip of claim 1, wherein said nanoparticles are coated with an organic coat comprising
2 a head-group and a tail-group;

3 wherein said head group comprises one of an amine, carboxylic acid, isocyanide, nitrile,
4 phosphene, phosphonic acid, sulfonic acid, thiol, and trichlorosilane; and

5 wherein said tail-group comprises one of an alkyl chain, aryl chain, fluorocarbon, siloxane,
6 fluorophore, DNA, carbohydrate, and protein.

1 6. The tip of claim 1, wherein said tip is coated with an adhesion layer comprising of one of
2 n-(2-aminoethyl) 3-aminopropyl-trimethoxysilane, polyethyleneimine, polymethylmethacrylate,
3 epoxy, cyanoacrylate adhesive, and an α,ω alkyl chain.

1 7. The tip of claim 1, wherein said layer of chemically-synthesized nanoparticles is at least
2 one nanoparticle thick.

1 8. The tip of claim 1, wherein said layer of chemically-synthesized nanoparticles is a single
2 layer of nanoparticles thick and covers only the apex of said tip.

1 9. The tip of claim 1, wherein said layer of chemically-synthesized nanoparticles comprises a
2 single nanoparticle affixed to an apex of said tip.

1 10. A method of forming a scanning probe microscope tip, said method comprising:
2 dipping said scanning probe microscope tip into a solution of nanoparticles; and
3 withdrawing said scanning probe microscope tip from said solution;
4 wherein said step of dipping causes said nanoparticles to attach to said scanning probe

5 microscope tip,

6 wherein said scanning probe microscope tip comprises a tip apex.

1 11. The method of claim 10, wherein said step of dipping said scanning probe microscope tip
2 into a solution of nanoparticles comprises dipping said scanning probe microscope tip into a
3 monolayer of nanoparticles floating on a liquid subphase.

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1 12. The method of claim 10, wherein said step of dipping said scanning probe microscope tip
2 into a solution of nanoparticles comprises inking an elastomer with a plurality of nanoparticles;
3 and dipping said scanning probe microscope tip into said elastomer.

1 13. The method of claim 10, further comprising washing off said solution after said step of
2 withdrawing said scanning probe microscope tip from said solution, wherein said solution is a
3 nonvolatile solution.

1 14. The method of claim 10, further comprising applying an electric potential to said scanning
2 probe microscope tip prior to said step of dipping said scanning probe microscope tip into a
3 solution of nanoparticles.

1 15. The method of claim 14, wherein said solution further comprises an electrochemical
2 solution, a supporting electrolyte, and an electrode held at a neutral potential.

1 16. The method of claim 10, wherein said nanoparticles form a layer around said scanning
2 probe microscope tip, wherein said layer is one nanoparticle thick.

1 17. The method of claim 10, wherein said nanoparticles form a layer around said scanning
2 probe microscope tip, wherein said layer comprises a single layer of nanoparticles and covers only
3 said tip apex.

1 18. The method of claim 10, wherein only a single nanoparticle is affixed to said tip apex.

1 19. The method of claim 10, further comprising coating said scanning probe microscope tip
2 with an adhesion promoter prior to said step of dipping said scanning probe microscope tip into a
3 solution of nanoparticles.

1 20. The method of claim 10, wherein said step of dipping said scanning probe microscope tip
2 into a solution of nanoparticles comprises submerging said tip into said liquid solution.

1 21. The method of claim 10, wherein said nanoparticles form a layer around said tip, said
2 method further comprising exposing said layer of nanoparticles to one of a laser light, a beam of
3 electrons, ultraviolet light, and heat.

1 22. The method of claim 10, wherein said nanoparticles form a layer around said tip, said
2 method further comprising transforming said layer of nanoparticles into an electrically continuous
3 film by annealing.

1 23. The method of claim 10, wherein said nanoparticles form a layer around said tip, said
2 method further comprising orienting uniformly the magnetic axis of said nanoparticles by
3 annealing in the presence of a magnetic field.

1 24. A method of forming a scanning probe microscope tip, said method comprising:
2 coating said scanning probe microscope tip, with the exception of an apex of said tip, with
3 a sacrificial layer;
4 depositing nanoparticles over said tip; and
5 removing said sacrificial layer.

1 25. A method of forming a scanning probe microscope tip, said method comprising:
2 dipping said scanning probe microscope tip into a monolayer of nanoparticles floating on a
3 liquid subphase; and
4 withdrawing said scanning probe microscope tip from said liquid subphase;
5 wherein said step of dipping causes said nanoparticles to attach to said scanning probe
6 microscope tip,
7 wherein said scanning probe microscope tip comprises a tip apex.

1 26. A method of forming a scanning probe microscope tip, said method comprising:
2 inking an elastomer with a plurality of nanoparticles;
3 dipping said scanning probe microscope tip into said elastomer; and
4 withdrawing said scanning probe microscope tip from said elastomer;
5 wherein said step of dipping causes said nanoparticles to attach to said scanning probe
6 microscope tip,
7 wherein said scanning probe microscope tip comprises a tip apex.

1 27. A method of forming a scanning probe microscope tip, said method comprising:
2 dipping said scanning probe microscope tip into a liquid solution, wherein said liquid
3 solution is nonvolatile and further comprises a plurality of nanoparticles dispersed therein;
4 withdrawing said scanning probe microscope tip from said liquid solution; and
5 washing off said liquid solution, whereby said nanoparticles remain on said scanning probe
6 microscope tip,
7 wherein said step of dipping causes said nanoparticles to attach to said scanning probe
8 microscope tip,
9 wherein said scanning probe microscope tip comprises a tip apex.

1 28. A method of forming a scanning probe microscope tip, said method comprising:
2 dipping said scanning probe microscope tip into an electrochemical solution, wherein said
3 electrochemical solution comprises nanoparticles, a solvent, and an electrode held at a neutral
4 potential;

5 applying an electric potential to said scanning probe microscope tip; and
6 withdrawing said scanning probe microscope tip from said electrochemical solution;
7 wherein said step of dipping causes said nanoparticles to attach to said scanning probe
8 microscope tip,
9 wherein said scanning probe microscope tip comprises a tip apex.

1 29. The method of claim 28, wherein said electrochemical solution further comprises a
2 supporting electrolyte and a reference electrode.

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